

Patent No. 5,959,329). The rejection of claim 4 has been rendered moot by the cancellation of this claim without prejudice or disclaimer of the subject matter therein.

Applicants appreciate the Examiner's thorough examination of this application, especially the detailed citations which aided Applicants in reviewing the Examiner's comments. Applicants respectfully traverse the rejections, detailed above, for the following reasons.

Applicants respectfully disagree with the Examiner's arguments and conclusions. A *prima facie* case of obviousness has not been made, since the Examiner does not show that all the elements of Applicants' claims are met in the cited references, and does not show that there is any suggestion or motivation to modify the cited reference to result in the claimed invention. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." M.P.E.P. § 2143.03, p. 2100-26. Rhee, Teramoto, Komori, and Hsu, taken alone or in combination, do not teach or suggest at least the recitations of Applicants' independent claim 1.

First, the Examiner admitted that "Rhee does not necessarily teach [gate insulating film, Fig. 7] 60 to contain silicon, nitrogen, and oxygen ... nor does Rhee teach [oxide film, Fig. 7] 80 to contain silicon..." (Office Action, p. 3). The Examiner also admitted that "[neither] Rhee nor Teramoto necessarily teach the lower edge of the gate electrode to be of a rounded shape" (Office Action, p. 4).

Second, Rhee, Teramoto, Komori, and Hsu, taken alone or in combination, do not teach or suggest at least Applicants' claimed "post oxide film formed on the second region, containing silicon and oxygen and arranged to be in contact with the gate insulating film and the lower edge of the gate electrode, *wherein a nitrogen concentration of the post oxide film is lower than that of the gate insulation film.*" (Applicants' independent claim 1, italics added). According to Rhee's

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Figure 7, for example, there is no post oxide film either covering, or deposited next to, poly-Si gate electrodes 62 and 64. In contrast, Rhee's oxide film 80 is a field oxide film, which is completely different from Applicants' claimed post oxide film. None of the cited references teaches or suggests at least Applicants' claimed "nitrogen concentration of the post oxide film is lower than that of the gate insulation film."

Furthermore, Teramoto, Komori, and Hsu fail to cure the deficiencies of Rhee, since these additional references also does not teach or suggest the recitations of Applicants' present invention which are not taught or suggested in Rhee, namely, among other things, Applicants' claimed "nitrogen concentration of the post oxide film is lower than that of the gate insulation film." Furthermore, the Examiner's reliance on these references does not render the recitations of Applicants' independent or dependent claims obvious when combined with Rhee. For example, merely because Teramoto "teaches the application of  $\text{SiO}_x\text{N}_y$  as a thin gate insulation layer 506" (Office Action, p. 4), does not mean that one skilled in the art would have found it obvious to have then used Teramoto's film in combination with Rhee to result in Applicants' claimed invention.

As recited in Applicants' independent claim 1, the concentration of nitrogen in the post oxide film formed between the second region and the gate electrode is lower than the concentration of nitrogen in the gate insulating film formed between the first region and the gate electrode. Thus, a concentration of magnetic fields in the lower edge portion of the gate electrode can be effectively suppressed.

As such, when the concentration of nitrogen in the post oxide film formed between the second region and the gate electrode is lower than the concentration of nitrogen in the gate insulating film formed between the first region and the gate electrode (as in Applicants'

independent claim 1), the dielectric constant of the post oxide film becomes lower than that of the gate insulating film, and consequently, the vertical magnetic field of the substrate surface in the second region and the surface of the lower edge portion of the gate electrode is reduced. Therefore, a concentration of electric fields in the lower edge portion of the gate electrode can be suppressed.

In contrast, none of the cited references discloses or contains any teaching that "a nitrogen concentration of the post oxide film is lower than that of the gate insulation film," as Applicants claim. For example, Teramoto teaches an  $\text{SiO}_x\text{N}_y$  film, as mentioned above, wherein the concentration of nitrogen in  $\text{SiO}_x\text{N}_y$  film 107 in the lower edge portion of the gate electrode is equal to the concentration of nitrogen in the  $\text{SiO}_x\text{N}_y$  film 107 in the channel portion of the gate electrode, as can be understood from Teramoto's Figs. 1A-1E and the corresponding descriptions.

The Examiner then alleges that the several elements lacking in Rhee, Teramoto, Komori, and Hsu have "long been recognized," or have "long been known" (Office Action, p. 4), which Applicants' continue to dispute. Even with the deficiencies of the prior art taken into consideration, the Examiner's mischaracterization of the present invention still does not establish that there would have been the requisite suggestion or motivation to modify any of the cited references. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

Finally, since the structures taught by Rhee, Teramoto, Komori, and Hsu do not produce Applicants' claimed invention, it could not be obvious to combine them in order to achieve the

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present claimed invention. Even considering the combination of these references, Applicants point out to the Examiner that it "is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art" (see *In re Wesslau*, 147 U.S.P.Q. 391, C.C.P.A. 1965). See also M.P.E.P. § 2141.02, 8<sup>th</sup> Ed., Aug. 2001.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03. Therefore, Applicants respectfully submit that the Examiner should withdraw the 35 U.S.C. § 103(a) rejection.

Regarding the rejections pertaining to dependent claims 2, 3, 5, and 7, Applicants respectfully remind the Examiner that "[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03, p. 2100-26. Furthermore, "Examiners are reminded that a dependent claim is directed to a combination including everything recited in the base claim and what is recited in the dependent claim. It is this combination that must be compared with the prior art, exactly as if it were present as one independent claim." M.P.E.P. § 608.01(n)(III), p. 600-77.

By the reasons already argued, Applicants have demonstrated the patentability of Applicants' independent claim 1. The addition of Takemura and/or Tomita, in the rejections of dependent claims 5 and 7, respectively, still does not cure the deficiencies of Rhee, Teramoto, Komori, and Hsu as applied to Applicants' independent claim 1, in that they still do not address the features of Applicants' present invention not taught or suggested by Rhee, Teramoto,

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Komori, and Hsu. Therefore, Applicants submit that dependent claims 2, 3, 5, and 7 are also allowable at least by virtue of their dependence from allowable base claim 1.

**Conclusion:**

In view of the foregoing, Applicants submit that the rejections of the claims, detailed above, are improper and should be withdrawn. Applicants submit that pending claims 1 – 3, 5, and 7 are in condition for allowance. A favorable action is requested.

Should the Examiner continue to dispute the patentability of the claims after consideration of this Amendment, Applicants invite the Examiner to contact Applicants' representatives by telephone to discuss any remaining issues.

Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: September 13, 2002

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**APPENDIX TO AMENDMENT FILED SEPTEMBER 13, 2002**  
**"VERSION OF CLAIM WITH MARKINGS TO SHOW CHANGES MADE"**

**AMENDMENTS TO THE CLAIM:**

Please amend claim 1 as follows:

1. (Three Times Amended) A semiconductor device comprising:

a semiconductor substrate having a main plane in which a channel of a transistor is formed, the semiconductor substrate comprising a first region and a second region defined in a section taken along a direction of a channel length, the second region having a surface located lower than that of the first region, and the second region being connected to the first region;

a gate insulating film formed on the first region and containing silicon, nitrogen and oxygen;

a gate electrode formed on the gate insulating film, a lower edge of the gate electrode being in a round shape and containing silicon; and

a post oxide film formed on the second region, containing silicon and oxygen and arranged to be in contact with the gate insulating film and the lower edge of the gate electrode, wherein a nitrogen concentration of the post oxide film is lower than that of the gate insulation film.

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